



$I(J^P) = 0(\frac{1}{2}^+)$ Status: ***

In the quark model, a Λ_b^0 is an isospin-0 $ud\bar{b}$ state. The lowest Λ_b^0 ought to have $J^P = 1/2^+$. None of I , J , or P have actually been measured.

Λ_b^0 MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5620.2 ± 1.6 OUR AVERAGE				
5619.7 ± 1.2 ± 1.2		1 ACOSTA 06	CDF	$p\bar{p}$ at 1.96 TeV
5621 ± 4 ± 3		2 ABE 97B	CDF	$p\bar{p}$ at 1.8 TeV
5668 ± 16 ± 8	4	3 ABREU 96N	DLPH	$e^+e^- \rightarrow Z$
5614 ± 21 ± 4	4	3 BUSKULIC 96L	ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		4 ABE 93B	CDF	Sup. by ABE 97B
5640 ± 50 ± 30	16	5 ALBAJAR 91E	UA1	$p\bar{p}$ 630 GeV
5640 +100 -210	52	BARI	91	SFM $\Lambda_b^0 \rightarrow p D^0 \pi^-$
5650 +150 -200	90	BARI	91	SFM $\Lambda_b^0 \rightarrow \Lambda_c^+ \pi^+ \pi^- \pi^-$

¹ Uses exclusively reconstructed final states containing a $J/\psi \rightarrow \mu^+ \mu^-$ decays.

² ABE 97B observed 38 events above a background 18 ± 1.6 events in the mass range 5.60 – 5.65 GeV/c^2 , a significance of > 3.4 standard deviations.

³ Uses 4 fully reconstructed Λ_b events.

⁴ ABE 93B states that, based on the signal claimed by ALBAJAR 91E, CDF should have found 30 ± 23 $\Lambda_b^0 \rightarrow J/\psi(1S)\Lambda$ events. Instead, CDF found not more than 2 events.

⁵ ALBAJAR 91E claims 16 ± 5 events above a background of 9 ± 1 events, a significance of about 5 standard deviations.

$\Lambda_b - \Lambda_b^0$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
339.2 ± 1.4 ± 0.1	6 ACOSTA 06	CDF	$p\bar{p}$ at 1.96 TeV

⁶ Uses exclusively reconstructed final states containing a $J/\psi \rightarrow \mu^+ \mu^-$ decays.

Λ_b^0 MEAN LIFE

These are actually measurements of the average lifetime of weakly decaying b baryons weighted by generally unknown production rates, branching fractions, and detection efficiencies. Presumably, the mix is mainly Λ_b^0 , with some Ξ_b^0 and Ξ_b^- .

See b -baryon Admixture section for data on b -baryon mean life average over species of b -baryon particles.

“OUR EVALUATION” is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group

(HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/rescaling procedure takes into account correlations between the measurements and asymmetric lifetime errors.

<u>VALUE</u> (10^{-12} s)	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$1.409^{+0.055}_{-0.054}$ OUR EVALUATION				
1.593 $^{+0.083}_{-0.078}$ ± 0.033	7 ABULENCIA	07A CDF	$p\bar{p}$ at 1.96 TeV	
1.22 $^{+0.22}_{-0.18}$ ± 0.04	7 ABAZOV	05C D0	$p\bar{p}$ at 1.96 TeV	
1.11 $^{+0.19}_{-0.18}$ ± 0.05	8 ABREU	99W DLPH	$e^+ e^- \rightarrow Z$	
1.29 $^{+0.24}_{-0.22}$ ± 0.06	8 ACKERSTAFF	98G OPAL	$e^+ e^- \rightarrow Z$	
1.21 ± 0.11	8 BARATE	98D ALEP	$e^+ e^- \rightarrow Z$	
1.32 ± 0.15 ± 0.07	9 ABE	96M CDF	$p\bar{p}$ at 1.8 TeV	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.19 $^{+0.21}_{-0.18}$ $^{+0.07}_{-0.08}$	ABREU	96D DLPH	Repl. by ABREU 99W	
1.14 $^{+0.22}_{-0.19}$ ± 0.07	69 AKERS	95K OPAL	Repl. by ACKER-STAFF 98G	
1.02 $^{+0.23}_{-0.18}$ ± 0.06	44 BUSKULIC	95L ALEP	Repl. by BARATE 98D	
7 Measured mean life using fully reconstructed $\Lambda_b^0 \rightarrow J/\psi \Lambda$ decays.				
8 Measured using $\Lambda_c \ell^-$ and $\Lambda \ell^+ \ell^-$.				
9 Excess $\Lambda_c \ell^-$, decay lengths.				

$\tau_{\Lambda_b^0}/\tau_{B^0}$ MEAN LIFE RATIO

$\tau_{\Lambda_b^0}/\tau_{B^0}$ (direct measurements)

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.02 ± 0.05 OUR AVERAGE			
1.041 ± 0.057	10 ABULENCIA	07A CDF	$p\bar{p}$ at 1.96 TeV
0.87 $^{+0.17}_{-0.14}$ ± 0.03	10 ABAZOV	05C D0	$p\bar{p}$ at 1.96 TeV

10 Measured mean life ratio using fully reconstructed decays.

Λ_b^0 DECAY MODES

These branching fractions are actually an average over weakly decaying b -baryons weighted by their production rates in Z decay (or high-energy $p\bar{p}$), branching ratios, and detection efficiencies. They scale with the LEP b -baryon production fraction $B(b \rightarrow b\text{-baryon})$ and are evaluated for our value $B(b \rightarrow b\text{-baryon}) = (9.2 \pm 1.8)\%$.

The branching fractions $B(b\text{-baryon} \rightarrow \Lambda \ell^- \bar{\nu}_\ell \text{anything})$ and $B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything})$ are not pure measurements because the underlying measured products of these with $B(b \rightarrow b\text{-baryon})$ were used to determine $B(b \rightarrow b\text{-baryon})$, as described in the note “Production and Decay of b -Flavored Hadrons.”

For inclusive branching fractions, e.g., $B \rightarrow D^\pm$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 J/\psi(1S)\Lambda$	$(4.7 \pm 2.8) \times 10^{-4}$	
$\Gamma_2 p D^0 \pi^-$		
$\Gamma_3 \Lambda_c^+ \pi^-$	$(8.8 \pm 3.2) \times 10^{-3}$	
$\Gamma_4 \Lambda_c^+ a_1(1260)^-$	seen	
$\Gamma_5 \Lambda_c^+ \pi^+ \pi^- \pi^-$		
$\Gamma_6 \Lambda K^0 2\pi^+ 2\pi^-$		
$\Gamma_7 \Lambda_c^+ \ell^- \bar{\nu}_\ell$ anything	[a] $(9.9 \pm 2.5) \%$	
$\Gamma_8 \Lambda_c^+ \ell^- \bar{\nu}_\ell$	$(5.0^{+1.9}_{-1.4}) \%$	
$\Gamma_9 \Lambda_c^+ \pi^+ \pi^- \ell^- \bar{\nu}_\ell$	$(5.6 \pm 3.1) \%$	
$\Gamma_{10} p h^-$	[b] $< 2.3 \times 10^{-5}$	90%
$\Gamma_{11} p \pi^-$	$< 5.0 \times 10^{-5}$	90%
$\Gamma_{12} p K^-$	$< 5.0 \times 10^{-5}$	90%
$\Gamma_{13} \Lambda \gamma$	$< 1.3 \times 10^{-3}$	90%

[a] Not a pure measurement. See note at head of Λ_b^0 Decay Modes.

[b] Here h^- means π^- or K^- .

Λ_b^0 BRANCHING RATIOS

$\Gamma(J/\psi(1S)\Lambda)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE (units 10^{-4})	EVTS DOCUMENT ID TECN COMMENT

4.7 ± 2.1 ± 1.9 11 ABE 97B CDF $p\bar{p}$ at 1.8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

196. ± 120. ± 38. 16 12 ALBAJAR 91E UA1 $J/\psi(1S) \rightarrow \mu^+ \mu^-$

11 ABE 97B reports $(0.037 \pm 0.017(\text{stat}) \pm 0.007(\text{sys}))\%$ for $B(b \rightarrow b\text{-baryon}) = 0.1$ and for $B(B^0 \rightarrow J/\psi(1S) K_S^0) = 0.037\%$. We rescale to our PDG 98 best value $B(b \rightarrow b\text{-baryon}) = (10.1^{+3.9}_{-3.1})\%$ and $B(B^0 \rightarrow J/\psi(1S) K_S^0) = (0.044 \pm 0.006)\%$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

12 ALBAJAR 91E reports $(180 \pm 110) \times 10^{-4}$ for $B(\bar{b} \rightarrow b\text{-baryon}) = 0.10$. We rescale to our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (9.2 \pm 1.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p D^0 \pi^-)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	52	BARI	91	SFM	$D^0 \rightarrow K^- \pi^+$
seen		BASILE	81	SFM	$D^0 \rightarrow K^- \pi^+$

$\Gamma(\Lambda_c^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
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8.8±2.8±1.5 13 ABULENCIA 07B CDF $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	3	ABREU	96N DLPH	$\Lambda_c^+ \rightarrow p K^- \pi^+$
seen	4	BUSKULIC	96L ALEP	$\Lambda_c^+ \rightarrow p K^- \pi^+,$ $p\bar{K}^0, \Lambda\pi^+\pi^+\pi^-$

13 The result is obtained from $(f_{\text{baryon}}/f_d) (B(\Lambda_b^0 \rightarrow \Lambda_c^+ \pi^-)/B(\bar{B}^0 \rightarrow D^+ \pi^-)) = 0.82 \pm 0.08 \pm 0.11 \pm 0.22$, assuming $f_{\text{baryon}}/f_d = 0.25 \pm 0.04$ and $B(\bar{B}^0 \rightarrow D^+ \pi^-) = (2.68 \pm 0.13) \times 10^{-3}$.

$\Gamma(\Lambda_c^+ a_1(1260)^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ
seen	1	ABREU	96N DLPH	$\Lambda_c^+ \rightarrow p K^- \pi^+,$ $a_1^- \rightarrow \rho^0 \pi^- \rightarrow \pi^+ \pi^- \pi^-$	

$\Gamma(\Lambda_c^+ \pi^+ \pi^- \pi^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	90	BARI	91 SFM	$\Lambda_c^+ \rightarrow p K^- \pi^+$	

$\Gamma(\Lambda K^0 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4	14 ARENTON	86 FMPS	$\Lambda K_S^0 2\pi^+ 2\pi^-$	

14 See the footnote to the ARENTON 86 mass value.

$\Gamma(\Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything})/\Gamma_{\text{total}}$

The values and averages in this section serve only to show what values result if one assumes our $B(b \rightarrow b\text{-baryon})$. They cannot be thought of as measurements since the underlying product branching fractions were also used to determine $B(b \rightarrow b\text{-baryon})$ as described in the note on "Production and Decay of b -Flavored Hadrons."

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ
0.099±0.025 OUR AVERAGE					
0.093±0.017±0.018		15 BARATE	98D ALEP	$e^+ e^- \rightarrow Z$	
0.13 ± 0.04 ± 0.03	29	16 ABREU	95S DLPH	$e^+ e^- \rightarrow Z$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.082±0.020±0.016	55	17 BUSKULIC	95L ALEP	Repl. by BARATE 98D	
0.16 ± 0.06 ± 0.03	21	18 BUSKULIC	92E ALEP	$\Lambda_c^+ \rightarrow p K^- \pi^+$	

- 15 BARATE 98D reports $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0086 \pm 0.0007 \pm 0.0014$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (9.2 \pm 1.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Measured using $\Lambda_c^+ \ell^-$ and $\Lambda \ell^+ \ell^-$.
- 16 ABREU 95S reports $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.0118 \pm 0.0026^{+0.0031}_{-0.0021}$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (9.2 \pm 1.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 17 BUSKULIC 95L reports $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.00755 \pm 0.0014 \pm 0.0012$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (9.2 \pm 1.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 18 BUSKULIC 92E reports $[B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{anything}) \times B(\bar{b} \rightarrow b\text{-baryon})] = 0.015 \pm 0.0035 \pm 0.0045$. We divide by our best value $B(\bar{b} \rightarrow b\text{-baryon}) = (9.2 \pm 1.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Superseded by BUSKULIC 95L.

 $\Gamma(\Lambda_c^+ \ell^- \bar{\nu}_\ell)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.050^{+0.011}_{-0.008}^{+0.016}_{-0.012}	19 ABDALLAH	04A DLPH	$e^+ e^- \rightarrow Z^0$

19 Derived from a combined likelihood and event rate fit to the distribution of the Isgur-Wise variable and using HQET. The slope of the form factor is measured to be $\rho^2 = 2.03 \pm 0.46^{+0.72}_{-1.00}$.

 $\Gamma(\Lambda_c^+ \pi^+ \pi^- \ell^- \bar{\nu}_\ell)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.056^{+0.031}_{-0.030}	20 ABDALLAH	04A DLPH	$e^+ e^- \rightarrow Z^0$

20 Derived from the fraction of $\Gamma(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell) / (\Gamma(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell) + \Gamma(\Lambda_b^0 \rightarrow \Lambda_c^+ \pi^+ \pi^- \ell^- \bar{\nu}_\ell)) = 0.47^{+0.10}_{-0.08}{}^{+0.07}_{-0.06}$.

 $\Gamma(\Lambda_c^+ \ell^- \bar{\nu}_\ell)/[\Gamma(\Lambda_c^+ \ell^- \bar{\nu}_\ell) + \Gamma(\Lambda_c^+ \pi^+ \pi^- \ell^- \bar{\nu}_\ell)]$

VALUE	DOCUMENT ID	TECN	COMMENT
0.47^{+0.10}_{-0.08}^{+0.07}_{-0.06}	ABDALLAH	04A DLPH	$e^+ e^- \rightarrow Z^0$

 $\Gamma(ph^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.3 × 10⁻⁵	90	21 ACOSTA	050 CDF	$p\bar{p}$ at 1.96 TeV

21 Assumes $f_{\Lambda}/f_d = 0.25$, and equal momentum distribution for Λ_b and B mesons.

 $\Gamma(p\pi^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.0 × 10⁻⁵	90	22 BUSKULIC	96V ALEP	$e^+ e^- \rightarrow Z$

22 BUSKULIC 96V assumes PDG 96 production fractions for B^0 , B^+ , B_s , b baryons.

$\Gamma(pK^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<5.0 × 10⁻⁵	90	23 BUSKULIC	96V ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<3.6 \times 10^{-4}$	90	24 ADAM	96D DLPH	$e^+e^- \rightarrow Z$
23 BUSKULIC 96V assumes PDG 96 production fractions for B^0 , B^+ , B_s , b baryons.				
24 ADAM 96D assumes $f_{B^0} = f_{B^-} = 0.39$ and $f_{B_s} = 0.12$.				

 $\Gamma(\Lambda\gamma)/\Gamma_{\text{total}}$ Γ_{13}/Γ

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<1.3 × 10⁻³	90	ACOSTA	02G CDF	$p\bar{p}$ at 1.8 TeV

 Λ_b^0 REFERENCES

ABULENCIA 07A	PRL 98 122001	A. Abulencia <i>et al.</i>	(FNAL CDF Collab.)
ABULENCIA 07B	PRL 98 122002	A. Abulencia <i>et al.</i>	(FNAL CDF Collab.)
ACOSTA 06	PRL 96 202001	D. Acosta <i>et al.</i>	(CDF Collab.)
ABAZOV 05C	PRL 94 102001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ACOSTA 05O	PR D72 051104R	D. Acosta <i>et al.</i>	(CDF Collab.)
ABDALLAH 04A	PL B585 63	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ACOSTA 02G	PR D66 112002	D. Acosta <i>et al.</i>	(CDF Collab.)
ABREU 99W	EPJ C10 185	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACKERSTAFF 98G	PL B426 161	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
BARATE 98D	EPJ C2 197	R. Barate <i>et al.</i>	(ALEPH Collab.)
PDG 98	EPJ C3 1	C. Caso <i>et al.</i>	
ABE 97B	PR D55 1142	F. Abe <i>et al.</i>	(CDF Collab.)
ABE 96M	PRL 77 1439	F. Abe <i>et al.</i>	(CDF Collab.)
ABREU 96D	ZPHY C71 199	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ABREU 96N	PL B374 351	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ADAM 96D	ZPHY C72 207	W. Adam <i>et al.</i>	(DELPHI Collab.)
BUSKULIC 96L	PL B380 442	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
BUSKULIC 96V	PL B384 471	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
PDG 96	PR D54 1	R. M. Barnett <i>et al.</i>	
ABREU 95S	ZPHY C68 375	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS 95K	PL B353 402	R. Akers <i>et al.</i>	(OPAL Collab.)
BUSKULIC 95L	PL B357 685	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABE 93B	PR D47 R2639	F. Abe <i>et al.</i>	(CDF Collab.)
BUSKULIC 92E	PL B294 145	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ALBAJAR 91E	PL B273 540	C. Albajar <i>et al.</i>	(UA1 Collab.)
BARI 91	NC 104A 1787	G. Bari <i>et al.</i>	(CERN R422 Collab.)
ARENTON 86	NP B274 707	M.W. Arenton <i>et al.</i>	(ARIZ, NDAM, VAND)
BASILE 81	LNC 31 97	M. Basile <i>et al.</i>	(CERN R415 Collab.)